AMENDMENTS TO THE CLAIMS

Please cancel claims 3, 6, 12, 15, 19, 25-26, 32 and 38-52, without prejudice, add claims 53-75 and amend the claims as follows:

1. (Currently Amended) A method ~~of~~ for forming a ~~film~~ ruthenium layer on a substrate, comprising:

positioning ~~the~~ a substrate within a process chamber; and

~~forming a ruthenium layer on at least a portion of~~ exposing the substrate ~~by~~ sequentially ~~chemisorbing monolayers of~~ to a ruthenium-containing compound and a reducing gas during an atomic layer deposition process to form a ruthenium material on the substrate, wherein the ruthenium-containing compound is selected from the group consisting of bis(2,4-dimethylpentadienyl) ruthenium, (2,4-dimethylpentadienyl) ruthenium (cyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (methylcyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (ethylcyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (isopropylcyclopentadienyl), derivatives thereof, and combinations thereof.

2. (Currently Amended) The method of claim 1, wherein the process chamber is purged with a purge gas and a deposition cycle of the atomic layer deposition process includes sequentially delivering the ruthenium-containing compound, the purge gas, the reducing gas and the purge gas into the process chamber ~~following chemisorption of each monolayer~~.

3. (Cancelled)

4. (Currently Amended) The method of claim ~~3~~ 1, wherein the reducing gas comprises one or more gases selected from the group consisting of hydrogen, atomic hydrogen, ammonia, silane, disilane, dimethylsilane, methylsilane, ethylsilane, chlorosilane, dichlorosilane, hexachlorodisilane, borane, diborane, triborane, tetraborane, pentaborane, triethylborane, derivatives thereof, and combinations thereof.

5. (Currently Amended) The method of claim 4, wherein ~~forming~~ the ~~ruthenium layer is performed at~~ substrate is heated to a temperature ~~in a range from about 200°C to~~ below about 400°C and the process chamber is pressurized to a pressure below about 80 Torr.

6. (Cancelled)

7. (Original) The method of claim 2, wherein the purge gas is selected from the group consisting of helium, argon, hydrogen, nitrogen, and combinations thereof.

8. (Currently Amended) The method of claim ~~6~~ 5, wherein the ruthenium-containing compound is pulsed into the process chamber for a duration within a range from about 0.05 seconds to about 1.5 seconds.

9. (Currently Amended) The method of claim 8, wherein the reducing gas is pulsed into the process chamber for a duration within a range from about 0.1 seconds to about 2 seconds.

10. (Currently Amended) The method of claim 7, wherein the purge gas is pulsed into the process chamber for a duration within a range from about 0.07 seconds to about 1 second.

11. (Currently Amended) The method of claim 4, wherein the ruthenium material ~~layer has~~ is formed having a thickness within a range from about 10 Å to about 100 Å.

12. (Cancelled)

13. (Currently Amended) The method of claim ~~12~~ 1, wherein the ruthenium-containing compound is ~~delivered normal~~ exposed to the substrate ~~with respect to the substrate~~ from an expanding channel.

14. (Currently Amended) A method ~~of~~ for forming a ruthenium layer on a substrate ~~for use in integrated circuit fabrication~~, comprising:

positioning ~~the~~ a substrate within a process chamber~~, wherein the process chamber is in fluid communication with a gas delivery system~~;

exposing the substrate to a carrier gas having a circular flow pattern; and

exposing the substrate sequentially to ~~delivering~~ a ruthenium-containing compound ~~from the gas delivery system to the process chamber; chemisorbing a ruthenium-containing layer on the substrate; delivering~~ and a reducing gas ~~from the gas delivery system to the process chamber; and reacting the reducing gas with the ruthenium-containing layer~~ to form ~~the~~ a ruthenium ~~layer~~ material on the substrate, wherein the ruthenium-containing compound and the reducing gas are sequentially pulsed into the carrier gas and the ruthenium-containing compound contains a 2,4-dimethylpentadienyl ligand.

15. (Cancelled)

16. (Currently Amended) The method of claim ~~15~~ 14, wherein the ruthenium-containing compound is selected from the group consisting of [[:]]
~~tris(2,2,6,6-tetramethyl-3,5-heptanedionato)ruthenium;~~
bis(2,4-dimethylpentadienyl)_ruthenium, [[;]]
~~dicarbonyl pentadienyl ruthenium; ruthenium acetyl acetonate;~~
(2,4-dimethylpentadienyl)_ruthenium_(cyclopentadienyl)_, [[;]]
~~bis(2,2,6,6-tetramethyl-3,5-heptanedionato)ruthenium(1,5-cyclooctadiene);~~
(2,4-dimethylpentadienyl)_ruthenium_(methylcyclopentadienyl)_, [[;]]
~~(1,5-cyclooctadiene)ruthenium(cyclopentadienyl);~~
~~(1,5-cyclooctadiene)ruthenium(methylcyclopentadienyl);~~
~~(1,5-cyclooctadiene)ruthenium(ethylcyclopentadienyl);~~
(2,4-dimethylpentadienyl)_ruthenium_(ethylcyclopentadienyl)_, [[;]]
(2,4-dimethylpentadienyl)_ruthenium_(isopropylcyclopentadienyl), derivatives thereof, [[;]] ~~bis(N,N-dimethyl-1,3-tetramethyl diiminato)ruthenium(1,5-cyclooctadiene);~~

~~bis(N,N-dimethyl-1,3-dimethyl-diiminato)ruthenium(1,5-cyclooctadiene);~~
~~bis(allyl)ruthenium(1,5-cyclooctadiene), (η^6-C_6H_6)ruthenium(1,3-cyclohexadiene);~~
~~bis(1,1-dimethyl-2-aminoethoxylate)ruthenium(1,5-cyclooctadiene);~~
~~bis(1,1-dimethyl-2-aminoethylaminato)ruthenium(1,5-cyclooctadiene);~~
and combinations thereof.

17. (Currently Amended) The method of claim 16, wherein the reducing gas comprises one or more gases selected from the group consisting of hydrogen, atomic hydrogen, ammonia, silane, disilane, dimethylsilane, methylsilane, ethylsilane, chlorosilane, dichlorosilane, hexachlorodisilane, borane, diborane, triborane, tetraborane, pentaborane, triethylborane, derivatives thereof, and combinations thereof.

18. (Currently Amended) The method of claim 17, wherein ~~forming~~ the ~~ruthenium layer is performed at~~ substrate is heated to a temperature ~~in a range from about 200°C to~~ below about 400°C and the process chamber is pressurized to a pressure below about 80 Torr.

19. (Cancelled)

20. (Currently Amended) The method of claim ~~15~~ 14, wherein the ~~purge~~ carrier gas is selected from the group consisting of helium, argon, hydrogen, nitrogen, and combinations thereof.

21. (Currently Amended) The method of claim ~~19~~ 18, wherein the ruthenium-containing compound is pulsed into the ~~process chamber~~ carrier gas for a duration within a range from about 0.05 seconds to about 1.5 seconds.

22. (Currently Amended) The method of claim 21, wherein the reducing gas is pulsed into the ~~process chamber~~ carrier gas for a duration within a range from about 0.1 seconds to about 2 seconds.

23. (Cancelled)

24. (Currently Amended) The method of claim 17, wherein the ruthenium material ~~layer has~~ is formed having a thickness within a range from about 10 Å to about 100 Å.

25-26. (Cancelled)

27. (Currently Amended) A method for forming a layer comprising ruthenium on a substrate ~~surface~~ within a process chamber, ~~sequentially~~ comprising:

a) exposing ~~the~~ a substrate ~~surface~~ to a ruthenium-containing compound to form a ruthenium-containing layer thereon, wherein the ruthenium-containing compound contains a 2,4-dimethylpentadienyl ligand ~~on the substrate surface~~;

b) purging the process chamber with a purge gas;

c) ~~reacting~~ exposing the substrate to a reducing gas ~~with the~~ to form a ruthenium [[-containing layer]] material thereon; and

d) purging the process chamber with the purge gas.

28. (Currently Amended) The method of claim 27, wherein the ~~layer~~ ruthenium material is formed by repeating an ALD process cycle ~~including repeating~~ of steps a-d.

29. (Currently Amended) The method of claim 28, wherein the ruthenium-containing compound is selected from the group consisting of [[:]]

~~tris(2,2,6,6-tetramethyl-3,5-heptanedionato)ruthenium;~~

bis(2,4-dimethylpentadienyl)_ruthenium, [[;]]

~~dicarbonyl pentadienyl ruthenium; ruthenium acetyl acetonate;~~

(2,4-dimethylpentadienyl)_ruthenium_(cyclopentadienyl)_, [[;]]

~~bis(2,2,6,6-tetramethyl-3,5-heptanedionato)ruthenium(1,5-cyclooctadiene);~~

(2,4-dimethylpentadienyl)_ruthenium_(methylcyclopentadienyl)_, [[;]]

~~(1,5-cyclooctadiene)ruthenium(cyclopentadienyl);~~

~~(1,5-cyclooctadiene)ruthenium(methylcyclopentadienyl);~~

~~(1,5-cyclooctadiene)ruthenium(ethylcyclopentadienyl);~~

(2,4-dimethylpentadienyl)_ruthenium_(ethylcyclopentadienyl)_, [[;]] (2,4-dimethylpentadienyl)_ruthenium_(isopropylcyclopentadienyl), derivatives thereof, [[;]] ~~bis(N,N-dimethyl-1,3-tetramethyl-diiminato)ruthenium(1,5-cyclooctadiene); bis(N,N-dimethyl-1,3-dimethyl-diiminato)ruthenium(1,5-cyclooctadiene); bis(allyl)ruthenium(1,5-cyclooctadiene), (η^6-C_6H_6)ruthenium(1,3-cyclohexadiene); bis(1,1-dimethyl-2-aminoethoxylate)ruthenium(1,5-cyclooctadiene); bis(1,1-dimethyl-2-aminoethylaminato)ruthenium(1,5-cyclooctadiene);~~ and combinations thereof.

30. (Currently Amended) The method of claim 29, wherein the reducing gas comprises one or more gases selected from the group consisting of hydrogen, atomic hydrogen, ammonia, silane, disilane, dimethylsilane, methylsilane, ethylsilane, chlorosilane, dichlorosilane, hexachlorodisilane, borane, diborane, triborane, tetraborane, pentaborane, triethylborane, derivatives thereof, and combinations thereof.

31. (Currently Amended) The method of claim 30wherein ~~forming~~ the ~~ruthenium layer is performed at~~ substrate is heated to a temperature ~~in a range from about 200°C to~~ below about 400°C and the process chamber is pressurized to a pressure below about 80 Torr.

32. (Cancelled)

33. (Original) The method of claim 28, wherein the purge gas is selected from the group consisting of helium, argon, hydrogen, nitrogen, and combinations thereof.

34. (Currently Amended) The method of claim ~~32~~ 31, wherein the ruthenium-containing compound is pulsed into the process chamber for a duration within a range from about 0.05 seconds to about 1.5 seconds.

35. (Currently Amended) The method of claim 34, wherein the reducing gas is pulsed into the process chamber for a duration within a range from about 0.1 seconds to about

2 seconds.

36. (Currently Amended) The method of claim 33, wherein the purge gas is pulsed into the process chamber for a duration within a range from about 0.07 seconds to about 1 second.

37. (Currently Amended) The method of claim 30, wherein ~~repeating~~ steps a-d are repeated to form [[s]] the ruthenium material ~~layer with~~ having a thickness within a range from about 10 Å to about 100 Å.

38-52. (Cancelled)

53. (New) The method of claim 13, wherein the expanding channel is positioned to expose the substrate to a carrier gas.

54. (New) The method of claim 53, wherein the carrier gas is delivered from the expanding channel having a circular flow pattern.

55. (New) The method of claim 54, wherein a deposition cycle of the atomic layer deposition process includes sequentially delivering the ruthenium-containing compound and the reducing gas into the carrier gas.

56. (New) The method of claim 55, wherein the reducing gas contains a member selected from the group consisting of hydrogen, atomic hydrogen, ammonia, derivatives thereof, and combinations thereof.

57. (New) The method of claim 56, wherein the carrier gas contains a gas selected from the group consisting of hydrogen, nitrogen, argon, helium, and combinations thereof.

58. (New) The method of claim 54, wherein the circular flow pattern is selected from the group consisting of a vortex pattern, a helix pattern, a spiral pattern, a derivative

thereof, and a combination thereof.

59. (New) The method of claim 14, wherein the circular flow pattern is formed as the carrier gas passes through an expanding channel positioned within the process chamber.

60. (New) The method of claim 59, wherein the reducing gas contains a member selected from the group consisting of hydrogen, atomic hydrogen, ammonia, derivatives thereof, and combinations thereof.

61. (New) The method of claim 59, wherein the circular flow pattern is selected from the group consisting of a vortex pattern, a helix pattern, a spiral pattern, a derivative thereof, and a combination thereof.

62. (New) The method of claim 27, wherein the process chamber contains an expanding channel positioned to expose the substrate to a carrier gas.

63. (New) The method of claim 62, wherein the carrier gas is delivered from the expanding channel having a circular flow pattern.

64. (New) The method of claim 63, wherein the ruthenium-containing compound is pulsed into the carrier gas.

65. (New) The method of claim 64, wherein the purge gas is the carrier gas.

66. (New) The method of claim 65, wherein the reducing gas contains a member selected from the group consisting of hydrogen, atomic hydrogen, ammonia, derivatives thereof, and combinations thereof.

67. (New) The method of claim 65, wherein the carrier gas contains a gas selected from the group consisting of hydrogen, nitrogen, argon, helium, and combinations thereof.

68. (New) The method of claim 67, wherein the circular flow pattern is selected from the group consisting of a vortex pattern, a helix pattern, a spiral pattern, a derivative thereof, and a combination thereof.

69. (New) A method for forming a ruthenium layer on a substrate, comprising:

positioning a substrate on a substrate support within a process chamber;

flowing a carrier gas through an expanding channel substantially axially positioned with the substrate, wherein the carrier gas forms a circular flow pattern along the expanding channel; and

exposing the substrate to the carrier gas while pulsing a ruthenium-containing compound into the carrier gas to form a ruthenium material on the substrate.

70. (New) The method of claim 69, wherein the carrier gas contains a gas selected from the group consisting of hydrogen, nitrogen, argon, helium, and combinations thereof.

71. (New) The method of claim 70, wherein the circular flow pattern is selected from the group consisting of a vortex pattern, a helix pattern, a spiral pattern, a derivative thereof, and a combination thereof.

72. (New) The method of claim 69, wherein a reducing gas and the ruthenium-containing compound are sequentially pulsed into the carrier gas and the reducing gas contains a member selected from the group consisting of hydrogen, atomic hydrogen, ammonia, silane, disilane, diborane, derivatives thereof, and combinations thereof.

73. (New) The method of claim 69, wherein the ruthenium-containing compound and a reducing gas are sequentially pulsed into the carrier gas and the ruthenium-containing compound contains a 2,4-dimethylpentadienyl ligand.

74. (New) The method of claim 73, wherein the ruthenium-containing compound is selected from the group consisting of bis(2,4-dimethylpentadienyl) ruthenium, (2,4-

dimethylpentadienyl) ruthenium (cyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (methylcyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (ethylcyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (isopropylcyclopentadienyl), derivatives thereof, and combinations thereof.

75. (New) The method of claim 69, wherein the ruthenium-containing compound is selected from the group consisting of tris(2,2,6,6-tetramethyl-3,5-heptanedionato) ruthenium, bis(2,4-dimethylpentadienyl) ruthenium, dicarbonyl pentadienyl ruthenium, ruthenium acetyl acetonate, (2,4-dimethylpentadienyl) ruthenium (cyclopentadienyl), bis(2,2,6,6-tetramethyl-3,5-heptanedionato) ruthenium (1,5-cyclooctadiene), (2,4-dimethylpentadienyl) ruthenium (methylcyclopentadienyl), (1,5-cyclooctadiene) ruthenium (cyclopentadienyl), (1,5-cyclooctadiene) ruthenium (methylcyclopentadienyl), (1,5-cyclooctadiene) ruthenium (ethylcyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (ethylcyclopentadienyl), (2,4-dimethylpentadienyl) ruthenium (isopropylcyclopentadienyl), bis(N,N-dimethyl 1,3-tetramethyl diiminato) ruthenium (1,5-cyclooctadiene), bis(N,N-dimethyl 1,3-dimethyl diiminato) ruthenium (1,5-cyclooctadiene), bis(allyl) ruthenium (1,5-cyclooctadiene), (η^6-C_6H_6) ruthenium (1,3-cyclohexadiene), bis(1,1-dimethyl-2-aminoethoxylato) ruthenium (1,5-cyclooctadiene), bis(1,1-dimethyl-2-aminoethylaminato) ruthenium (1,5-cyclooctadiene), derivatives thereof, and combinations thereof.